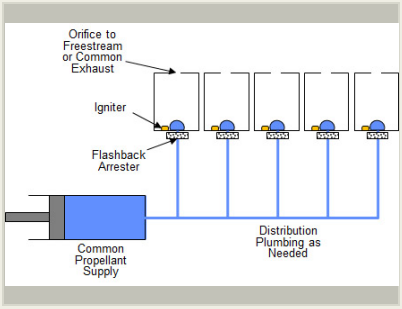
Advanced Chemically-Based Actuation for Active Flow Control, Phase I

Completed Technology Project (2017 - 2017)

Project Introduction

The proposed SBIR program by Virtual AeroSurface Technologies (VAST) focuses on the development of a novel variant of pulsed blowing active flow control in which chemically-based flow control actuators are utilized to create high-impulse pulsed jets from discrete reaction chambers with a flowable propellant mixture provided to each. Chemically-based actuation is capable of producing high-impulse jets with sufficient control authority for full-scale flight vehicles and speeds, and, compared to other pulsed blowing flow control schemes, this type of actuation inherently requires less energy from other flight systems as the energy used to create the high jet momentum is stored chemically within the propellant. This general actuation approach has been successfully demonstrated before in the form of COMPACT (in which gaseous fuel and air are repetitively combusted to form pulsed jets for control of separation) and gas generator actuators (in which microfabricated combustion chambers with solid propellant mixtures are utilized for single-shot trajectory control of spin-stabilized projectiles). The innovation proposed here (in which flowable propellant is dynamically supplied to the chambers from an integrated local reservoir) will eliminate the challenges and infrastructure associated with supplying large volumes of air which are necessary for most pulsed blowing approaches and, to a lesser extent, for COMPACT. The proposed Phase I program will investigate multiple propellant chemical compositions, mechanisms for delivering the fuel and oxidizer compounds to the actuator chamber, and methodology for successful repetitive initiation of the chemical reaction within the chamber. A benchtop prototype with repetitive firing will be demonstrated at the end of the Phase I program. A prospective Phase II follow-on program will proceed to develop and demonstrate large arrays of these actuators and perform wind tunnel demonstrations of their utility for active flow control.



Advanced Chemically-Based Actuation for Active Flow Control, Phase I Briefing Chart Image

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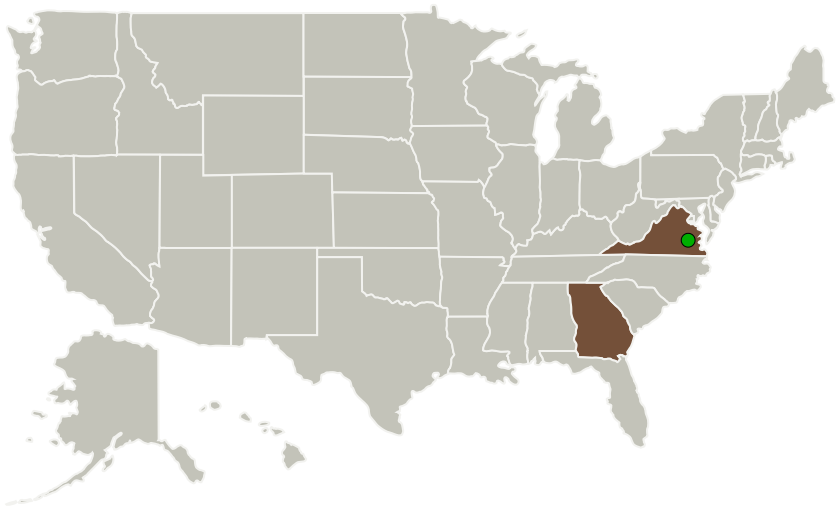
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Virtual AeroSurface Technologies	Lead Organization	Industry	Smyrna, Georgia
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Georgia	Virginia

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Virtual AeroSurface Technologies

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

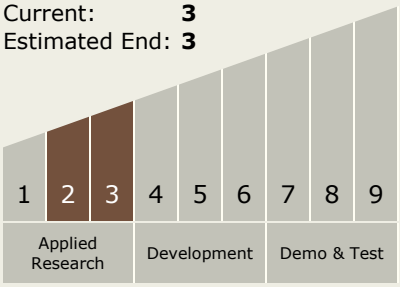
Carlos Torrez

Principal Investigator:

Thomas Crittenden

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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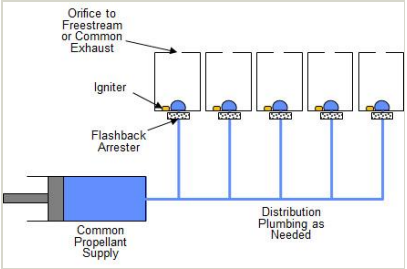
Images



Briefing Chart Image
Advanced Chemically-Based Actuation for Active Flow Control, Phase I Briefing Chart Image *(https://techport.nasa.gov/image/126731)*

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.5 Propulsion Flowpath and Interactions

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System